CA2ALA 2
44 E42

ept of Agriculture
tension Div.

CA2 ALA 2 1944E42
Electricity on the Farm.
1
3 3398 00128 8082

70

October, 1944

ALBERTA PROVINCIAL LIBRARY
JAN 26

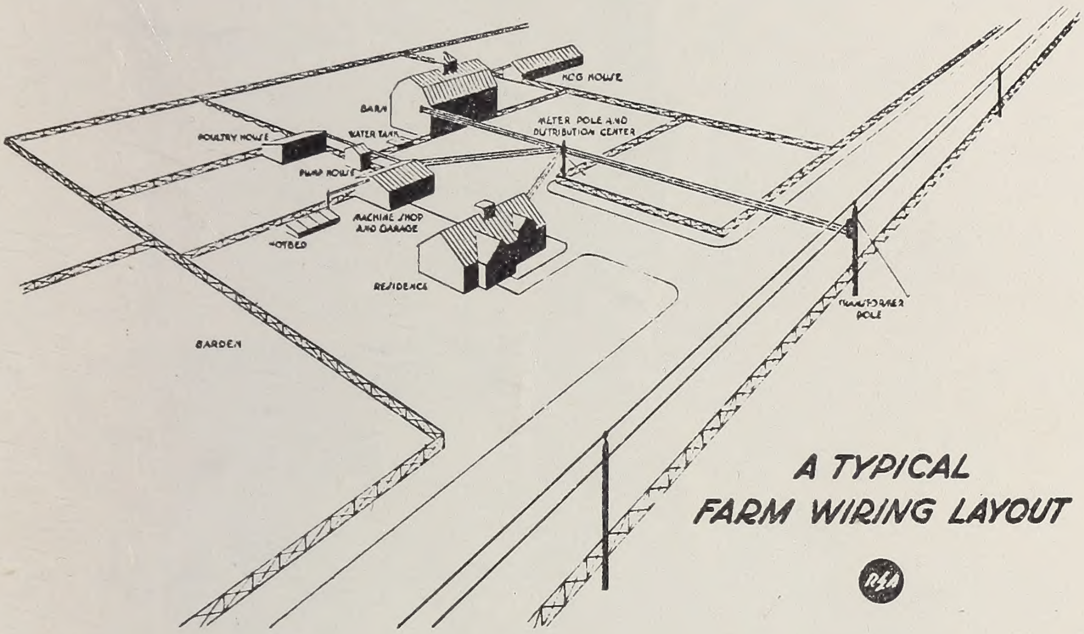
DEPARTMENT OF AGRICULTURE
ALBERTA

ELECTRICITY ON THE FARM

BY

B. T. STEPHANSON

Agricultural Engineer



A TYPICAL
FARM WIRING LAYOUT

●

Published by the Direction of
HON D. B. MacMILLAN,
Minister of Agriculture

●

Distributed By
AGRICULTURAL EXTENSION SERVICE
Department of Agriculture
EDMONTON - ALBERTA

LIBRARY
VAULT 19

Digitized by the Internet Archive
in 2018 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

https://archive.org/details/electricityonfar1944albe

ELECTRICITY ON THE FARM

Applications:

The application of electricity to agriculture is a recent development. The use of electricity may not only provide better lighting, added conveniences, leisure time and improved living conditions for the rural family, but it may be a means of increasing the farm income. Electricity is used in the home for lighting, cooking, refrigeration, washing, ironing and for operating the radio and other appliances.

On the farm it may be used for pumping water, milking cows, cooling milk, separating cream, sterilizing milking utensils, churning, providing cold storage, increasing egg production, hatching eggs, brooding chicks, stimulating the growth of plants and animals, trapping insects, lighting yards and buildings, ringing burglar alarms on poultry houses, heating soil in hot beds, drying fruits and vegetables and operating all kinds of power driven machines, such as saws, spraying machines, feed cutters, emery wheels, grindstones and sheep shears. In fact there are over 200 uses for electricity in agriculture and its use on the farm is limited only by the imagination of the farmer.

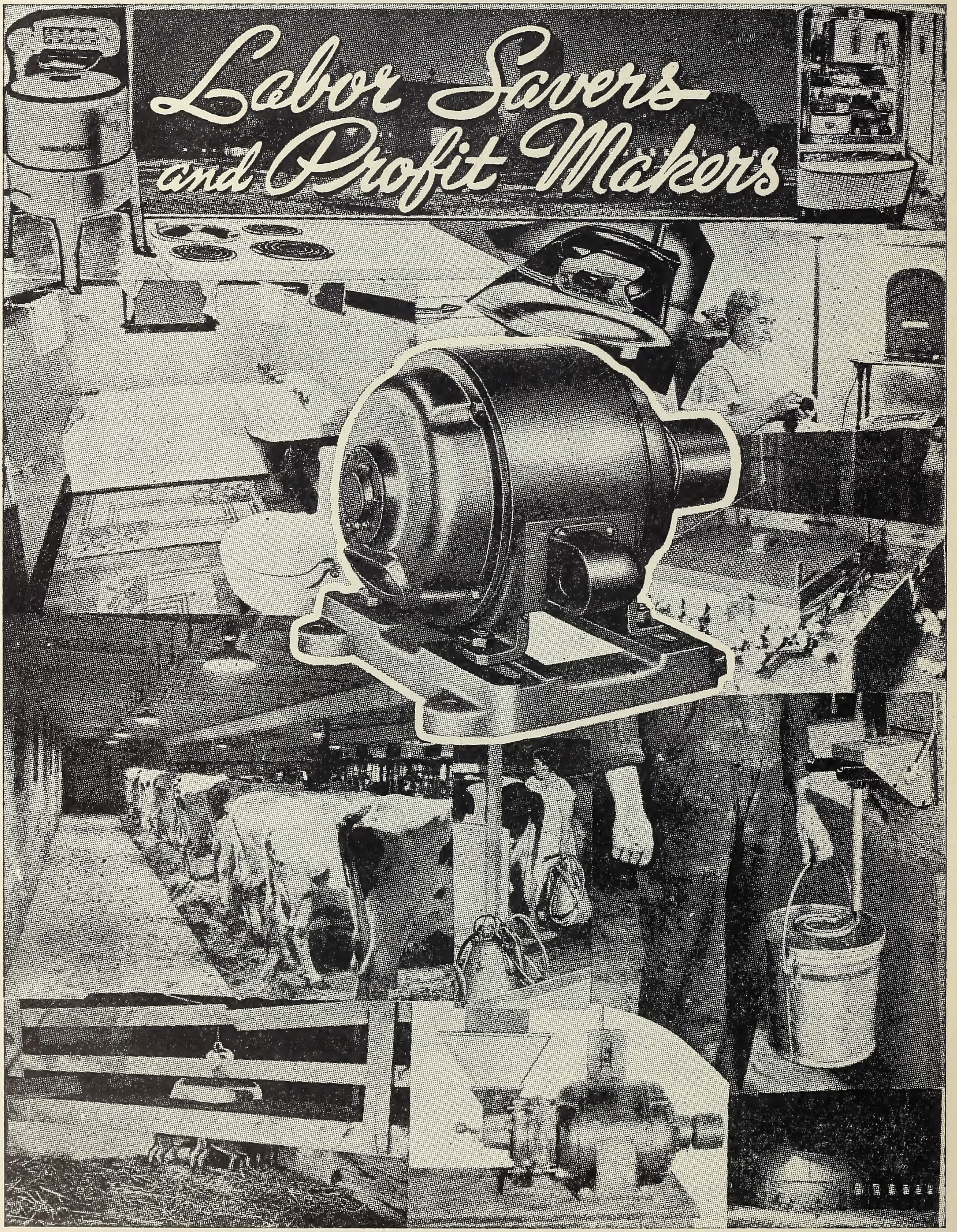
The Manitoba Electrification Enquiry Commission, 1942 reported that: "Electricity on the farm has profound and far reaching effects upon the social as well as economic aspects of farming. It reduces drudgery upon the farm as it has done in the factory, it increases income, reduces costs of production and by removing the disparity between the urban and rural way of life brings a large measure of contentment to people upon the farm."

"A man working with his own muscle alone can never do, in a day, the equivalent of work done by one kilowatt hour of electricity, which unit of energy rarely costs more than 5 to 10 cents. No other form of power for the farm can compare with the low cost, convenience and adaptability of central station electric service."

It is an accepted fact that electricity is the most convenient source of light, heat and power.

Sources of Electricity:

There are two sources of electricity for the farm, the individual electric plant operated by a water wheel, windmill or gas


Labor Savers
and Profit Makers

engine on the farm and the central power plant operated by a public or privately owned power company which supplies current over high voltage lines.

Individual farm plants will provide electricity for lighting and small appliances, but are limited in the amount of electricity that they can provide for power and heating. Small plants do not supply electricity as cheaply as it can be supplied from a central station plant.

A 1,000 watt unit provides service approaching that of a central station. It can supply limited service to small motors up to ¾ h.p., refrigerator, hotplate, electric iron, washing machine and most of the usual small household appliances.

Gasoline and wind driven units both have advantages and disadvantages. The wind driven unit requires less attention and has no fuel cost but depends upon the wind for its power. The gasoline driven plants require fairly skilled attention to keep them in good running order and the fuel represents a continuous running cost.

Where central station service is not available limited electric service can be obtained by either gasoline or wind driven units; both have a role to play in farm electrification.

In 1941 only 20% of farms in Canada had electricity, ranging from 4.7% to 37% for each of different provinces. Alberta farms are about 5.5% electrified.

How is Electricity Measured:

An electrical circuit may be compared to a water system.

In water systems a difference of pressure forces a current of water through a pipe which has some resistance. The pressure is measured in pounds and the current is measured in gal. per minute.

In electrical circuits a difference of electrical pressure forces a current of electricity through a wire conductor which has some resistance. The pressure is measured in volts and the electrical current is measured in amperes.

The watt is the term which measures electric power or the rate of doing work, just as the horsepower is a measure of the capacity of an engine. One ampere of electricity flowing through a wire under pressure of 1 volt is equal to 1 watt. Thus watts are the product of the volts times the amperes.

The watt is a very small unit of power, so the term kilowatt, which means 1,000 watts, is commonly used. A kilowatt is equal to approximately 1 1/3 horsepower or one horsepower equals 746 watts.

The kilowatt-hour is the measure of work done by electric power. One kilowatt working for one hour will do one kilowatt-hour of work. Similarly 500 watts (one-half kilowatt) working for two hours will do one kilowatt hour of work. The kilowatt-hour (K.W.H.) is the unit by which electricity is bought.

Electricity is transmitted by electrical conductors—similar to water flow in a pipe. In transmitting this electricity the conductors must be large enough to carry the current required at the point of operation.

Most people, at one time or another, have observed what happens when a team or car or an engine is overloaded. The operator not only fails to do what he was trying to accomplish but usually has more trouble with some injury to his equipment and at least some loss of time. In the same way it is quite possible to overload the wires which carry electric currents in a house, and it is advisable to plan house wiring so that there will be little chance of overloading.

Electric wiring systems should be safe, adequate, economical and convenient.

Safe-wiring systems limit the dangers of fire and electric shock.

Adequate wiring is designed with sufficient capacity to operate properly all lights, motors and appliances that may be used at present and future dates.

Economical. It is cheaper to wire completely and adequately at the start than to make numerous additions and repairs.

Convenient wiring places lights, switches and outlets to give the greatest benefit from the current used.

Wiring systems must be passed by the Provincial Inspector before being used.

Cost of Electricity:

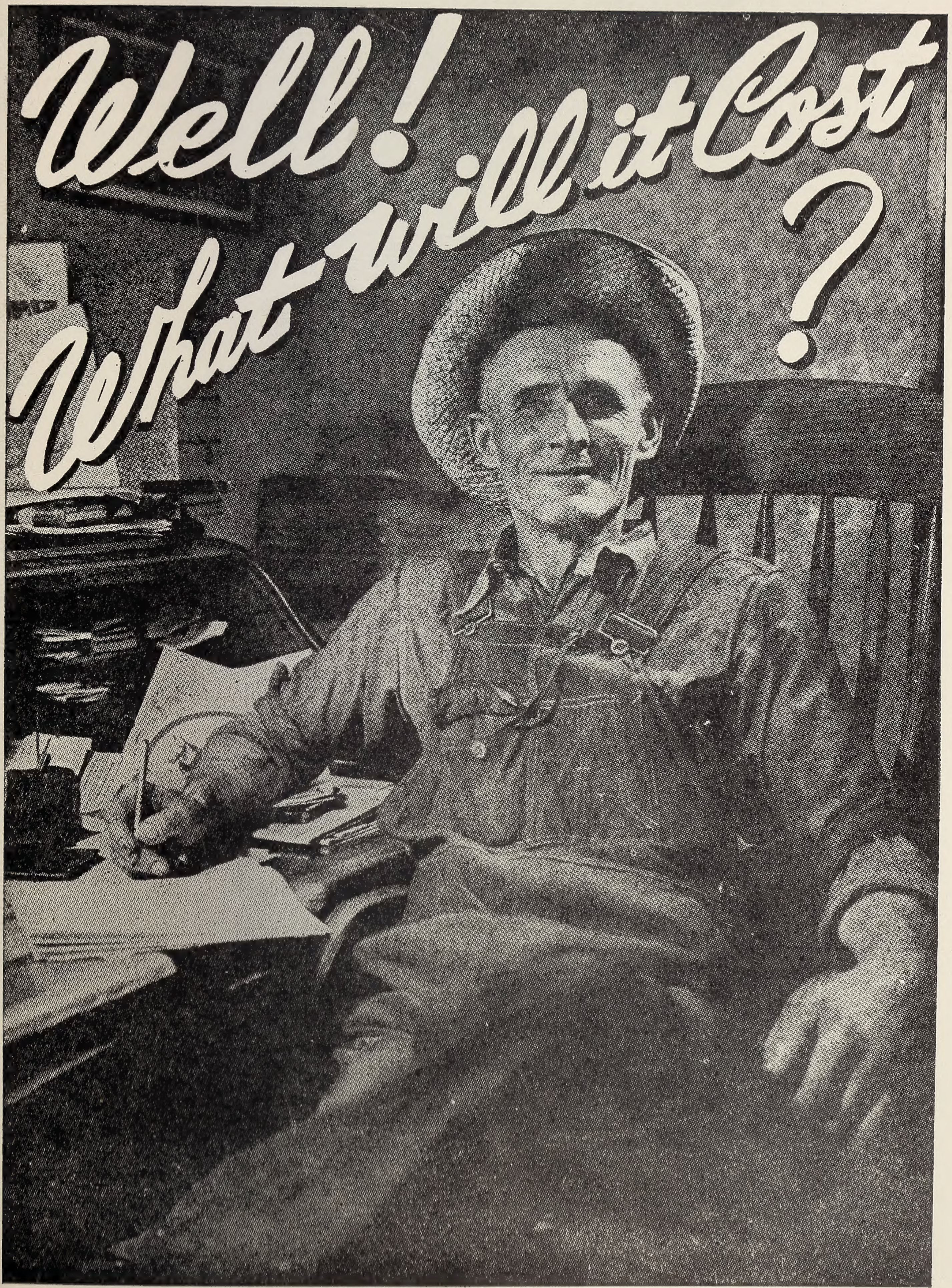
The average cost of producing electricity by the gasoline plant method has been estimated between 17 and 27 cents per K.W.H.

The average cost of producing electricity by the wind electric method has been from 10 to 20 cents per K.W.H.

The cost of electricity from central station plants varies from 4 to 12 cents per K.W.H.

It should be noted that the gasoline plant method has a compensating factor for the higher cost per K.W.H. as compared to wind electric, and this is that it doesn't depend on the wind for producing electricity and is, therefore, more reliable.

The electric utility industry has a well established rate policy which, within certain limits, is described by the phrase, "the more you use the less you pay per unit."


Well!
What will it Cost
?

Estimate of Monthly Cost of Current:

(*a*) *Central Station Power*

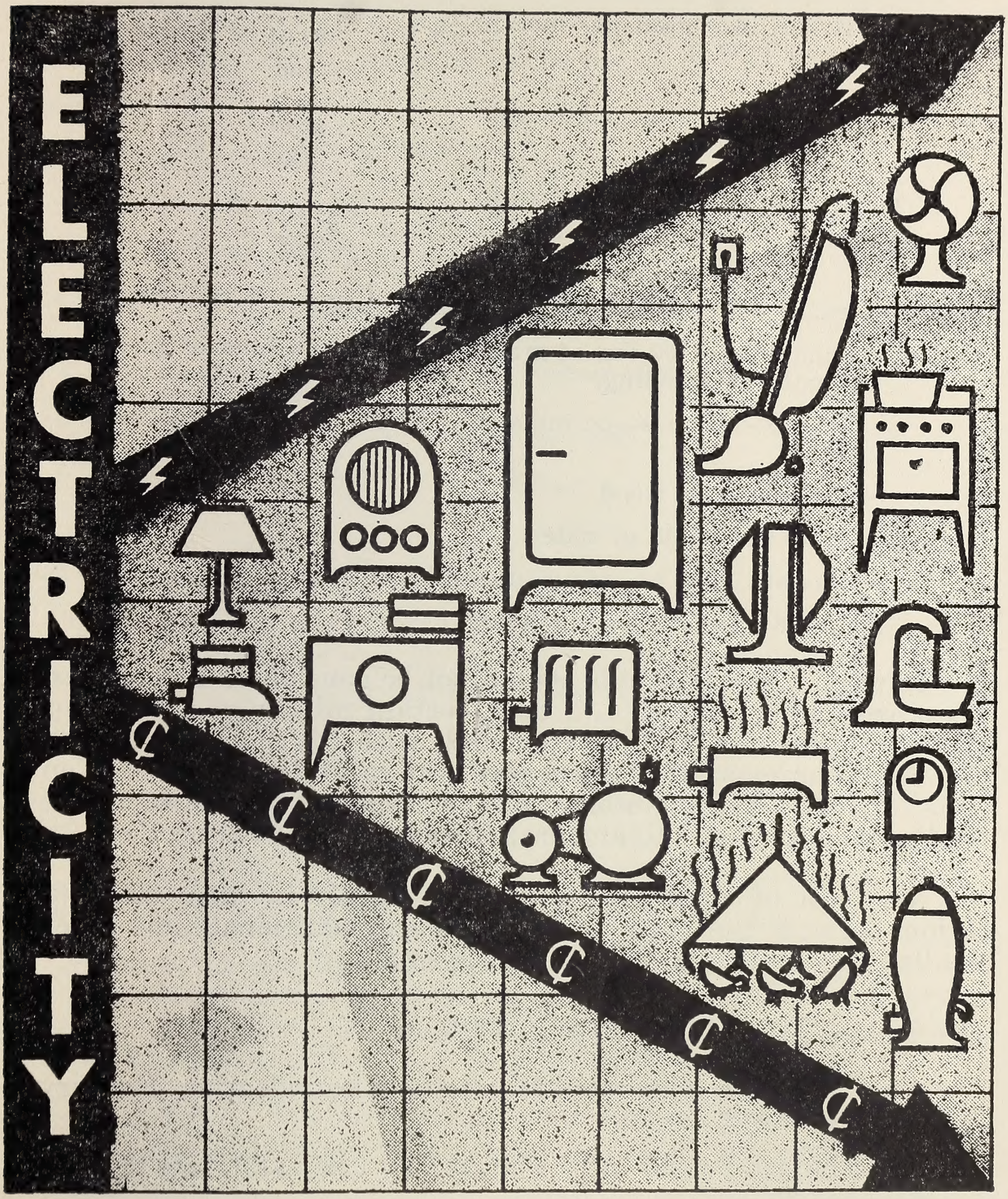
This estimate of monthly current costs may not apply to all parts of Alberta. Those districts, where the number of farm users per mile is less than the average, may have increased charges due to the increased cost of supplying power.

ESTIMATED MONTHLY ELECTRIC POWER BILL

APPLIANCE	Average K.W.H. Used Per Month	Cumulative Total K.W.H.	Min. Monthly Bill 20 K.W.H. at $5.00	All Over 20 K.W.H. at 2½c	Cost	Cumulative Total Bill for Month
Lights—House, buildings, small appliances	25	25	20	5	$5.13	$5.13
Radio	7	32		7	.17	5.30
Washing machine	3	35		3	.08	5.38
Flat iron	6	41		6	.15	5.53
Water pump—all farm uses	19	60		19	.48	6.01
Refrigerator	40	100		40	1.00	7.01
Feed grinder—1 ton	20	120		20	.50	7.51
Milk cooler—600 gallons	60	180		60	1.50	9.01
Range	120	300		120	3.00	12.01
Total	300	300	...	...	$12.01	$12.01

The above table shows the average consumption of different appliances and the cost of operating them. It also provides some interesting cost figures.

THE MORE YOU USE



THE CHEAPER IT GETS

If only 20 K.W.H. are used per month:
cost per K.W.H. .... $\frac{\$5.00}{20} = 25c$

If 50 K.W.H. are used per month:
cost per K.W.H. .... $\frac{\$5.76}{50} = 11\frac{1}{2}c$

If 100 K.W.H. are used per month:
cost per K.W.H. .... $\frac{\$7.01}{100} = 7c$

If 180 K.W.H. are used per month:
cost per K.W.H. .... $\frac{\$9.01}{180} = 5c$

If 300 K.W.H. are used per month:
cost per K.W.H. .... $\frac{\$12.01}{300} = 4c$

If electricity costs 5c per K.W.H. or less 5c will:

—grind 100 to 500 lbs. of grain, depending on kind of grain and fineness of grinding.

—milk 20-25 cows—portable milker; 10-15 cows—pipeline machine.

—saw a cord of wood.

—pump 1,000 gals. of water.

—separate 2,000 pounds of milk.

—turn a grindstone for 3 hours.

Minimum monthly bills should not be considered as charges. They are only guarantees to do a certain minimum amount of business, measured in kilowatt hours, with the utility company. The minimum monthly charges cover the capital and depreciation costs of the line, maintenance and repair, operation, meter reading and billing, line and transformer losses.

The cost of electricity is a minor factor in farm electrification because the costs to supply each additional unit after the lines are built and maintained is small.

(*b*) *Individual Gasoline Operated Plants*

Cost estimate made by Manitoba Electrification Enquiry Commission, 1942.

Generator and Engine—1,500 watt, 32 volt. Cost—$431. Life 15 years.

Battery—360 amp. hours. Cost—$265. Life—7 years.

Annual output—1,000 K.W.H.

Estimated Cost—1,000 K.W.H. per year.

Generating Plant:	*Annual Costs*
Depreciation—5.38% on $431	$ 23.19
Interest—3½%	15.75
Repairs—assumed 2%	8.62
Insurance—50c per $100	2.15
Fuel—based on 7c per K.W.H.	70.00
Oil	5.00
Battery:	
Depreciation—13.05% on $265	34.58
Interest—3½%	9.28
Insurance—50c per $100	1.32
Total Annual Cost	$169.89

Cost per K.W.H. $\frac{169.89}{1000}$ = 17c

If annual output is 500 K.W.H. Fuel consumption is ½ = $37.50
Fixed costs are the same.

Total annual cost for 500 K.W.H. per year - $132.39

Cost per K.W.H. $\frac{132.39}{500}$ = 26½c

Cost of Wiring and Appliances:

The wiring of the farm buildings may be the largest single expenditure. It may cost from $150 to $500 depending upon the number and size of buildings to be wired, the distance between them and the amount of wiring required for each one.

The cost of appliances will vary with the number desired. Small appliances will cost from $50 to $100—washing machine $100—refrigerator $100 to $300—range $150.

The minimum number of appliances will cost $150; for $1,000 a home may be completely electrified.

Because of the long distances between farms, the capital cost of serving farms in Western Canada for electrical power varies between $500 and $800 for each farm connected. This includes line construction costs, and installation of transformers. This high capital expenditure per farm makes it necessary to use the service fully. The use of a minimum amount of electricity for lighting only will result in ultimate failure of the system.

It is impossible to give farm service at reasonable rates and at the same time have a large staff of employees continuously patrolling farm lines or making long trips in response to minor trouble calls. This fact must be well understood at the outset and arrangements made for smooth working co-operation between the farm customer and the local power company representative.

One method by which the expenses may be cut down is to have the customer read his own meter and forward the information with payment regularly to the power company.

The farmer should grant full right-of-way for pole lines along the fences of his property and permit trimming of trees along the line free of charge.

USES FOR ELECTRICITY

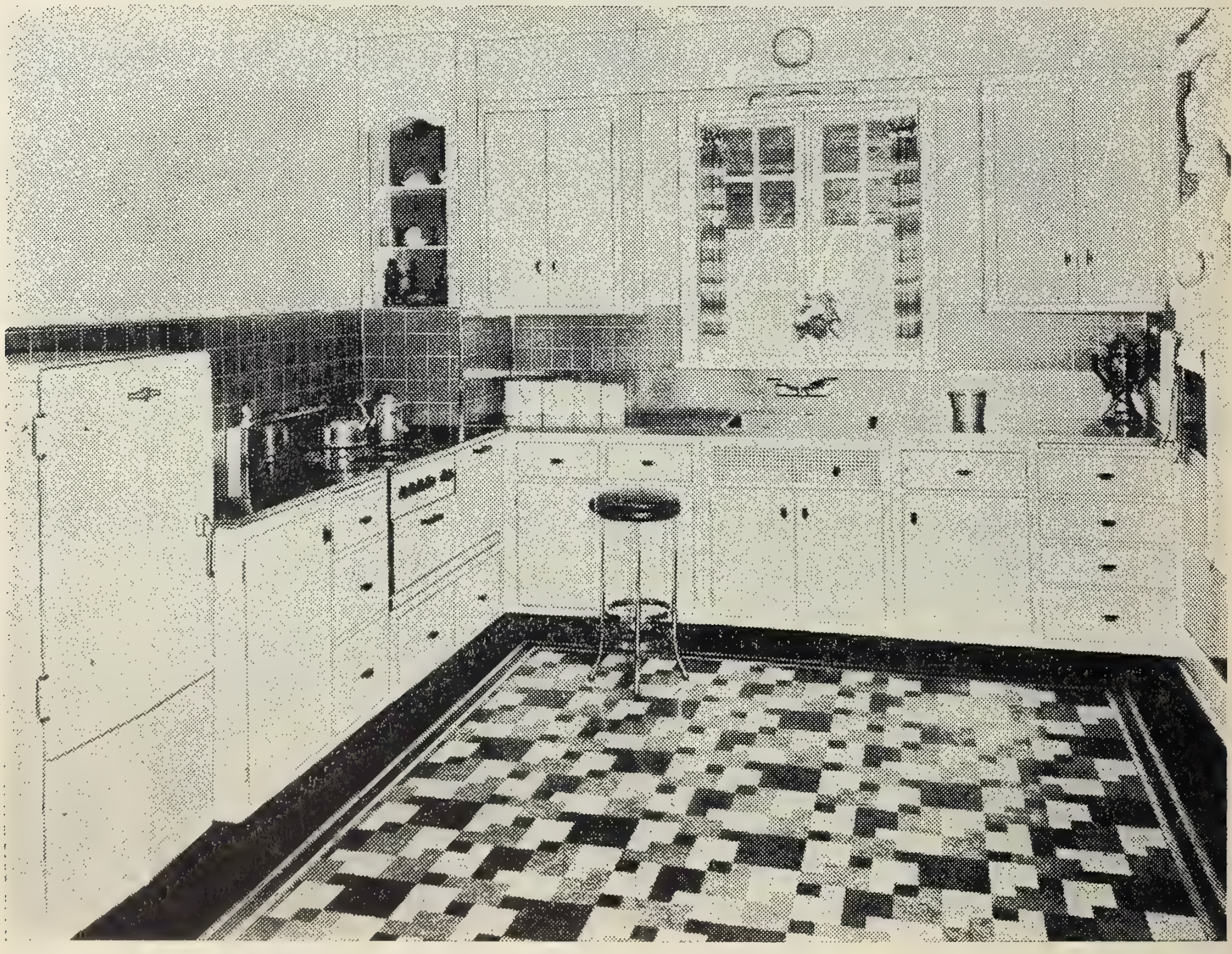
Lighting in the Home: One of the primary uses of electricity is to provide light. One should, therefore, be sure that fixtures meet the three requirements for providing efficient and proper lighting.

Enough light—determined by size of bulbs.

Properly distributed—controlled by reflectors and shades.

Without glare—avoid exposed bulbs.

Different activities in the farm house require different amounts of artificial light. Throughout the house there is need for general lighting to permit moving about in safety, to find things easily, and to make the rooms cheerful. In the kitchen and laundry the tasks require a somewhat higher general illumination.



A well planned farm kitchen with all the modern conveniences, running water, adequate lighting and electrical appliances. A pleasant place in which to work.

Reading, writing, studying, sewing and needlework all involve close seeing, often for long periods and, therefore, require ample light.

The value of good lighting cannot be measured in dollars and cents. Protection to eyes and nerves and added beauty for the home are the result of well planned and properly maintained lighting systems.

Even with electricity many people do not have the proper amount of lighting because they feel that the cost will be too great. Often times, however, the difference in cost between good and poor lighting is much less than people think. If the actual cost were known they would not hesitate to provide the additional wattage necessary to obtain adequate light.

Lighting in the Yard and Buildings:

Lights in the farm yard are a great aid in getting about and doing chores before sun up, and after sun down during the winter months. Light in and around buildings is important in case of fire, and to discover prowlers.

Good light in the milkroom and washroom promotes the cleanliness so important in producing high quality milk of low bacteria count, which increases income.

Lights in the shop and machine shed are very convenient and are often very necessary in order that machines may be repaired before the next day's work.

Where light is needed in the dairy barn, milk house, horse stables, hog houses and poultry houses the lamps should be installed in fixtures. Where light is needed only occasionally it may be supplied conveniently by portable lamps attached to extension cords.

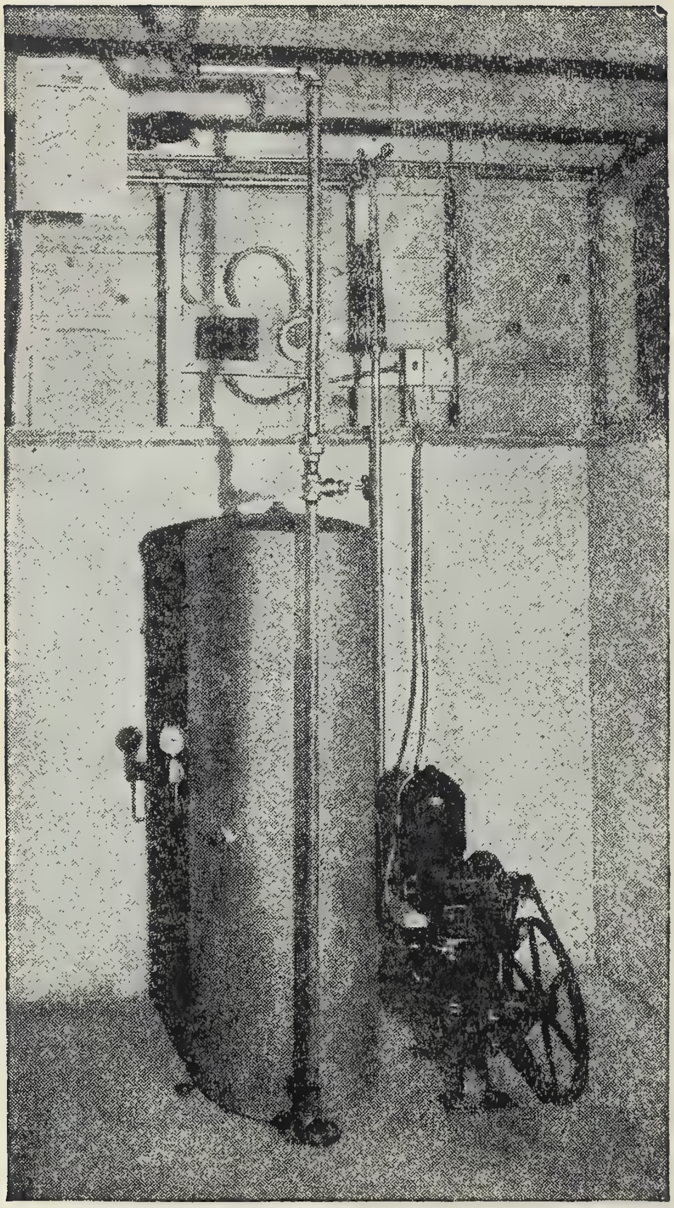
Yard lighting units should be placed at least 15 feet from the ground for best results.

Power in the Home

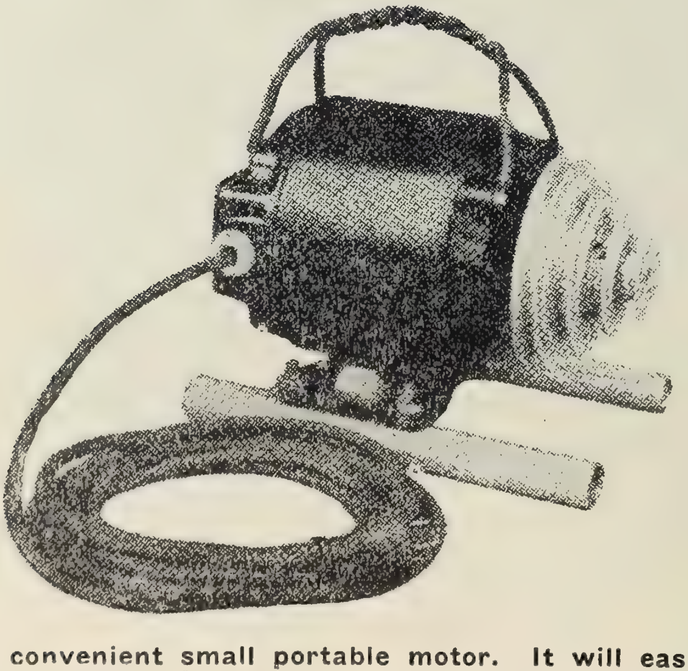
Electricity may be used in a variety of ways in the home.

The Manitoba Electrification Enquiry Commission in a survey made in 1942 reported that the first power appliances installed in the house were: iron, radio, washer, toaster, hotplate and refrigerator.

Other appliances that may be used are the range, sewing machine, clock, vacuum cleaner, fan, electric dishwasher, coffee maker, electric warming pads, electric mixers, home freezing units and churns.



A typical farm water supply with a shallow well pump. The luxury of running water can be had at a cost of a few cents per day.



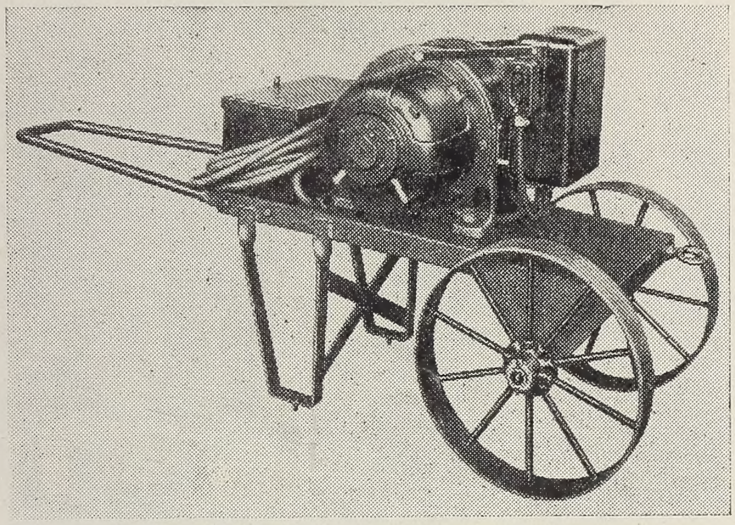
A convenient small portable motor. It will easily do the work of a man on any job to which it can be applied.

Power on the Farm

The first power requirement for the farm outside the house is a motor for pumping water. This is followed by the cream separator. Small electric motors are in great demand to do the ordinary manual labour, turning grindstones, emery wheels and cleaning grain.

There are many other uses for electricity in the buildings. These include: milking machines, feed grinding, clipping and grooming, silo filling, milk cooling, ventilation, chick brooders, electric water warmers, garden irrigation, spraying machines, grain elevating, wood sawing, pig brooders and hay driers.

Two portable motors, one small, ¼ to ½ H.P. and the other large, 3 H.P. can operate practically all farm machines that do not have a permanently attached motor.



A large portable motor which will handle the larger appliances around the farm.

On any job to which motor power can be applied a ¼ H.P. motor will easily do the work of a man.

A ¼ H.P. motor will work for an hour at a cost of 1.4c if electricity costs 5c per K.W.H.

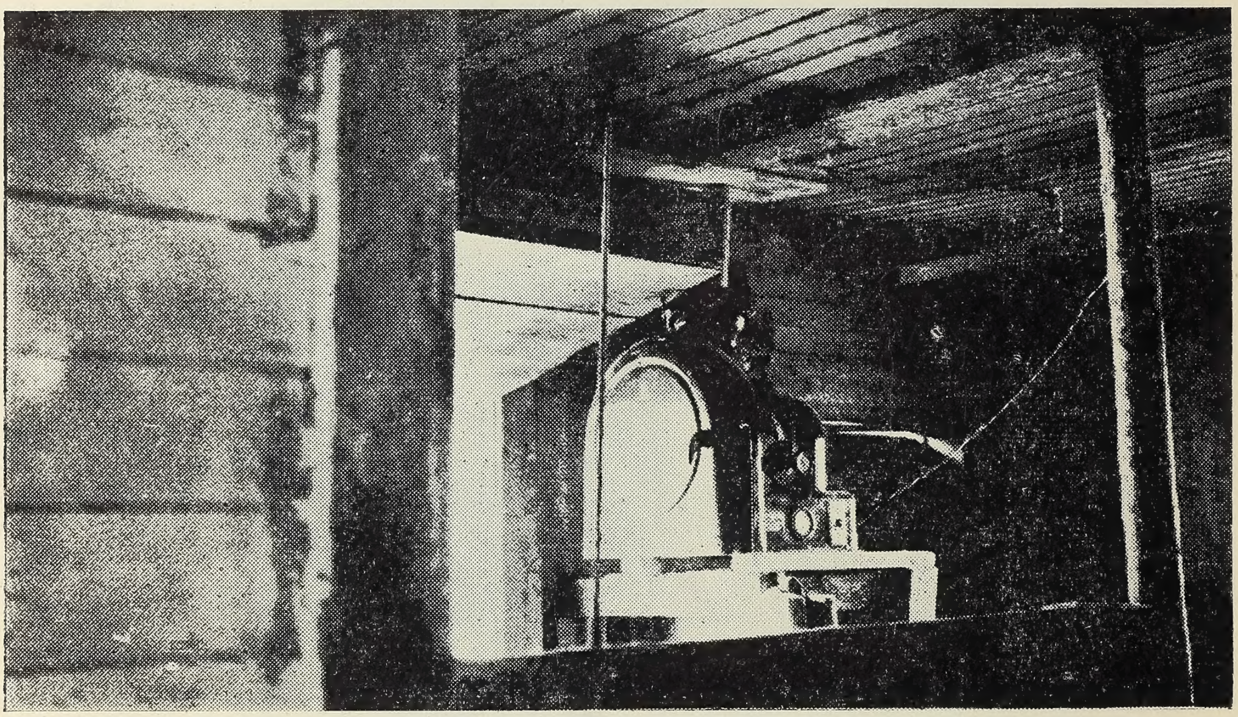
Some of the advantages of electric motors are: ease of starting, simplicity of operation, minimum servicing, long life, quiet and safe operation, portability, and low operating cost. The one disadvantage is that they must always be connected to a source of power by electrical conductors.

Small feed mills are increasing in popularity because of their low first cost and low cost of operation.

The successful operation of small feed mills depends to a large extent upon the use of overhead bins and making the system automatic to eliminate the necessity of constant watching.

With the use of electric motors in automatic or semi-automatic operation, the smallest power unit that will do the work satisfactorily should be used. This results in less investment in equipment and gives low costs per bushel of grain ground. The element of time or the amount of grain ground per hour are not of major importance, when the grinder can be left unattended.

Small mills that require from 1 to 3 H.P. are ideal for automatic operations because of their low first cost, and upkeep. They will also grind sufficient grain to take care of the feeding requirements on most farms with less than an hour of grinding each day. (1½ H.P. motor.)



A one H.P. hammer mill at the Olds School of Agriculture will grind grain at a cost of from 3 to 12 cents per 100 lbs., depending on degree of fineness.

Profits and Benefits from Using Electricity:

In addition to making life more satisfying, electricity is working marvellous changes in farm life.

The results of scientific experiments and practical experience are sufficiently clear to show that, in general, electric power on the farm tends to raise income and can quite easily reduce operating costs.

The contribution of electric power to increased income has been particularly marked in the case of poultry, hog and dairy production.

Numerous studies have been made showing the decreased mortality among chicks when using a simple home made chick brooder. Egg production may be stepped up by the use of electric lights in poultry houses.

Experience shows that the electric incubator is easier to keep at a uniform temperature and that it tends to give a higher number of chicks per 100 eggs set than the ordinary incubator.

Healthy poultry flocks need water at all times and it has been found that a constant supply of water will increase egg production. An automatic water system will supply the water for the poultry flock.

Cooling eggs immediately after gathering results in higher quality and higher prices. Simple egg coolers are easily made and cheap to operate and will give the farmer increased profit from egg production.

An easy way to increase hog production is the use of a home made pig brooder. The brooder is very easy to build and the cost is small. Hogs gain faster and are healthier when a brooder is used for the first two days to two weeks.

One of the easiest ways to produce more lambs and wool is to reduce the loss of lambs by exposure during the first few hours after the lamb is born. No perfect method for warming and drying the lamb has been developed but case histories show that deaths at birth are reduced very greatly by immediately placing the lamb in a brooder. Other aids in sheep raising are automatic feed grinder, water systems and electric sheep shears.

Other studies have demonstrated the great importance of water in the production of dairy products and beef cattle.

Milking time may be cut in half with the use of an electric milker. Clipping animals for showing is easily and quickly done with electric clippers.

The use of electricity on the farm allows the use of all modern improvements.

In the home and barn there may be an abundance of light and a constant supply of running water. This in contrast to the inconvenient and inadequate kerosene lamps and the labour of pumping water to supply household needs and to water the stock.

The use of electricity lightens the task of the farm women —tasks such as carrying heavy pails of water, keeping not-too-bright kerosene lamps in trim, turning washing machines and wringers and other burdensome tasks. Cooking may be done with greater safety and improved results. and can be done automatically. The electric washer, and ironer help very greatly in reducing the work required for this task. The electric refrigerator provides year around safe food preservation, convenience and economy.

The use of electricity on the farm tends to encourage diversified farming and so make the farmer more self-reliant.

With all the conveniences and advantages of electricity young people are encouraged to remain on the farm. Farm life can have all the advantages and improvements of urban areas together with the other advantages and enjoyments of farm living.

In the United States the Senate Committee on Agriculture and Forestry reported that:

"Experience shows that nothing can be more beneficial to the farmers and that nothing will add more to the comfort, satisfaction and happiness of the rural population than the electrification of farm homes."

Professor Andrew Stewart, University of Alberta, in "A Report to the Research Council of Alberta," states: "It can, however, be said that the advantages of rural electrification are great and widely recognized. These advantages accrue through the direct effort on the living conditions of rural people, and the indirect effect on the stability of rural population; through reduced expenses of production and the release of effort for other productive activity; and through farm and regional diversification with their stabilizing effect on the individual farmer and on the economy as a whole."

It is to be hoped that electric service, which has so long been denied them, will be available to an increasing number of farm men and women.

EDMONTON: Printed by A. Shnitka, King's Printer, 1944.